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## EFFICACY OF PODCAST ON NIGERIA CERTIFICATE OF EDUCATION BIOLOGY STUDENTS' ACHIEVEMENT IN INDIVIDUALIZED AND COLLABORATIVE SETTINGS

By

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### ABSTRACT

*This study investigates the efficacy of podcast on Nigeria Certificate in Education Biology Students' achievement in individualized and collaborative setting. Quasi-experimental Solomon III design was adopted for this study. A total number of 205 (96 male and 109 female) pre-service teachers were purposively selected for this study from Three Colleges of Education in Niger State and Federal Capital Territory, Abuja. The selected students were put into three groups: Think-Pair Share, Reciprocal peer Teaching groups (experimental group) and control group Individualized setting. Podcast Package on Teaching and Learning of Biology (PPTLB) and Plant Physiology Concepts on Achievement Test (PPCAT) were developed and validated by the Technology and Biology experts respectively with the reliability coefficient of 0.74 using kuder Recharadson (KR-21) which is considered reliable. The PPCAT was administered to students in the pretest, posttest upon treatment of the test instrument, and later reshuffled and administered in retention (delay test). Four research questions and null research hypotheses were formulated to guide the study and these hypotheses were tested at 0.05 level of significance. The data obtained from the pretest, posttest and retention were statistically analyzed by Analysis of Covariance (ANCOVA) using Statistical Package for Social Sciences (SPSS) version 20.0. The results of the study indicated that Reciprocal Peer Teaching enhanced students' achievement than Individualized Setting and Think- Pair- Share strategies. The results revealed that the individualized learning strategy is gender sensitive in favour of male students. Thus, it is recommended that prospective teachers should be exposed to the use of podcast for collaborative learning to supplement the lecture method.*

**Keywords:** Podcast, Collaborative Learning, Individualized Learning, Biology, Plant Physiology, Pre-service Teachers

### INTRODUCTION

Biology is the study of life. It has several branches which include botany (the study of plants), Zoology (the study of animals), Physiology (the study of living function), Ecology (the study of the relationship between living things and their environments), Genetics

(the study of how living things inherit characters from their parents), Cell biology (the study of structure and function) (Ndu, Asun & Aina, 2010). The study of biology helps students in developing basic skills, knowledge about their environment (Augustina & Anaun, 2014). The importance of Biology in the society cannot be

irrefutable. This importance is most noticeable in the areas of Agriculture, medicine, industry, and many others (Ibe, 2013). With all this importance of Biology student achievement are dwindling.

At tertiary level of education in Nigeria, students are continued to fail Biology because of problem that can be classified as governmental related, societal related, student related and non-availability of instructional materials for teaching and learning Biology. The poor achievement in Biology in tertiary institutions continue to persist most especially in plant physiology; there is no particular year in which students' achievement is above 40% in this course (National Commission for Colleges of Education Statistical Digest 2010-2014). This course is one of the most important aspects of Biology which seek to understand all the aspects of plant life in agreement with the major characteristics of living things. It is one of the core courses at colleges of education in Nigeria for graduation with lowest grade of C (merit) for any student that want to continue with their education in any of Nigerian University or abroad.

Emphasis is presently on child-centered strategy which involves hands-on, mind-on learning through constructivist teaching approach. Federal Republic of Nigeria (FRN, 2013). In the National Policy on Education stipulates that; Nigeria Education cannot rise above its teachers. Therefore, the success of Education and consequent better achievement among students depend on the quality of teachers being produced in the colleges of Education. To improve on the achievements of students in Biological concepts, it is important to have a paradigm shift and join the developed world in embracing constructivist approach to teaching and learning. The use of Information and Communication Technology has paved way to achieve such shift (Asan, 2012).

Information and communication Technology (ICT) in education is linked to higher efficiency,

productivity and higher educational outcomes. Studies have shown that the role of Information and Communication Technology in achieving quality education at all levels of school system in Nigeria cannot be overemphasized; this has led to the development of ICT policy in 2001. The use of ICT in education has paved way for the transition of learning from Traditional lecture method to the use of Electronic Learning (E-Learning) and other devices such as Personal Digital Assistant (PDA), Smartphone and mobile phones, for Mobile learning (M-learning).

Mobile learning (m-learning) can be defined as learning that is supported by portable devices such as mobile phones, PDA's and Laptops. It can take place anywhere and times. Podcasting is considered as a supplementary method in the context of recent mobile learning technologies and applications (Bell, Cockburn, Wingqvist & Green, 2007; Heilesen, 2010). (Kukulska-Hulme and Traxler (2005), opined that it offers education a number of benefits such as portability, accessibility, and convenience.

Podcasting is related to Mobile learning as students can access teaching and learning in the form of audio or video broadcasts on the move using any mobile device like tablets, smart phones or cell phones. Broadcast are published on the Internet and automatically downloaded on to a desktop or 'laptop computer. (Evans, 2008; Madiope, 2013). Podcasting is a portmanteau word based on iPod and broadcasting which means the diffusion of audio via the Internet (Ting, 2014). Podcasting is a digital audio or video file that can be saved for playback on a portable media or computer (Madiope, 2013). It refers to the creation and regular distribution of podcasts through the internet. Podcasts, which can include audio, video, PDF and E-pub files, can be subscribed to and subscribers are then able to view, listen to and transfer the episodes to a variety of media players (Hew, 2009). These podcasts are usually automatically downloaded for playback on mobile devices and/or personal

computers. Each newly posted podcast is usually referred to as an 'episode'. Thus, episodes in a series form a podcast 'channel', similar to that of radio and TV shows/channels. Furthermore, podcasting "enables users to quickly and easily download multimedia files, including audio and video, for playback on mobile devices including iPods and other MP3 players" which can improve students' achievement (Bausch & Han, 2006).

Attention has been shifted to podcasting in higher Education due to its multiple benefits. To begin with, podcasting allows learner to learn at any place and at any time as far as its convenience for them. Once the learners download any podcasts, it can be listened to at varieties of places and settings such on the Bus, at the gym, in the car, in the hostel or at home. (Madiopé, 2013). Podcasting has been found to increase satisfaction level, reducing anxieties and increasing clearness (Chan & Lee, 2005; Miller & Piller, 2005; Ractham & Zhang, 2006). Most especially, podcasting on mobile technology offers a convenient way of grasping the material by students who have not fully understood it in class or missed the lecture. It encourages them to learn the material more conveniently on their own (Tavales & Skevoulis, 2006). Although there is no substitute for personal interaction between students and educator, new technological tools can facilitate and enhance teaching-learning process. The low cost, user friendliness and effectiveness as a communication tool all validate the use of podcast in the classroom. However, it is an option for providing supplementary course content for student who did not understand well in class and those who are unable to attend class lecture (Scuuter, Stupans, Sawyer & King 2010).

A number of studies have reported that Podcasts can have positive effects on student academic achievement. For instance, a study by Brookes (2010), the finding revealed podcasts was perceived to have positive impact on the academic achievement when used

to provide formative feedback. Micknney, Dyck and Luber (2009) also conduct a study and found that student who watched podcasts with lectures largely out achieved those learners that saw only the lecture without podcasts.

Students, through mobile learning platform, can work together on a task, exchange ideas, views, experiences, opinions, discuss and negotiate strategies, actions and results (Vasilious & Ecomodes, 2007). These actions can provide students with opportunity to assist, explain, teach, understand, review and influence each other. By developing a learning community, it could also provide the opportunity to combine the special abilities of everyone to achieve a common goal in a collaborative means.

In the submission of Vasilious and Economides (2007), collaborative learning is a student-centered, task-based, activity-based learning approach that provides several advantages to students in tertiary institutions. It assists the students to enhance the skills of communication, interpersonal social interaction, cooperation of sharing and caring, openness, flexibility, adaptability, knowledge retention, higher-order of critical thinking, creativity, management, practicality, responsibility, trustworthiness of dependability, involvement, engagement of participation, commitment of persistency, motivation, confidence and self-efficacy. Meanwhile, it is an educational method in which students work together in small groups toward a common goal (Haffiner & Ellis, 2004). The successful achievement of the common goal is shared by all group members.

In addition, the students take initiative and responsibility for learning and actively learn by doing, by practice and by experience. Collaborative learning occurs when one stop relying on experts and teacher to transfer knowledge to students and instead engage together in making sense and creating meaning for the learners (Rhea, 2010). It was elucidated that collaboration taps into the power of an inclusive and

active group of learners to turn those wheels as fast as the speed of change and increasing complexity now required. Collaborative learning in an online classroom can take the form of discussion among the whole class or within smaller groups (Brindley, Walti & Blaschke, 2009). Groups in collaborative learning techniques are dynamic in the context of activities engagement as identified by Cerbin, (2010).

In a training workshop organized in the Center for Advancing Teaching and Learning in 2010 at the University of Wincousin, five major collaborative learning techniques were identified; Think-Pair-Share, (TPS), Reciprocal Peer Teaching (RPT), Think-Aloud Pair Problem Solving (TAPPS), Group Grid (GG), and Group Writing Assignment (GWA). Each of the identified collaborative group aforementioned has its dynamics and extent of collaboration mode. As mentioned earlier, Think- Pair- Share is a type of collaborative learning in which group members think about a question/topic individually, share their thoughts with a partner. Large group summarized sharing also occurs. The goal of a Think- Pair- Share is to allow participants time to think before they discuss. Research shows that when people are given time to contemplate an answer to a question, their answers differ from those they would give if they responded immediately. When doing a Think- Pair- Share, participants are given a specific amount of time like 30 seconds, 5 minutes, and so on for the "Think" portion.

Reciprocal Peer Teaching (RPT) on the other hand is a collaborative learning instructional strategy in which natural dialogue model reveals learners thinking processes about a shared learning experience. Teachers foster reciprocal peer teaching through their belief that collaborative construction of meaning between themselves and students takes ownership of their role in reciprocal peer teaching when they feel comfortable expressing their ideas and in open dialogue. Students take turns articulating and thinking out loud talking through their thoughts with each learning strategy

employed. The learning community is reinforce-understanding and to see, hear, and correct misconceptions that otherwise might not have been apparent. All members of the community have shared responsibility for leading experiences (Hashey & Connors, 2003). The teacher monitors and evaluates to determine where scaffolding is needed to help students become aware of their own learning processes and think critically about them compare to individualized learning.

Individualized learning is a method of teaching in which content, instructional technology and pace of learning are based upon the abilities and interest of each learner. This concurred with the work of Hobsons (2011), who believe learning is an individual thing, since students are not alike in their type of needs, interest, motivation and ability. Teachers' indicated that engaging in individualized learning allowed the students, with serving in that role with the same student throughout the four (4) years of higher institution, more effectively prepare students to make a successful post secondary transition (Achieve, 2010). When these kinds of methods are used in the delivery of content in any course in tertiary institutions supported with online podcast, Mobile learning lead to Understanding of the content in a dynamics way which would increase achievement in that course (dooly, 2008).

Gender has been defined by Afonja (2002), as a socially constructed concept based on the assumed power and position that group of humans should possess. Some researchers have indicated the influence of gender on podcasts. Those researchers include; Robin and Greensmith, (2008); Bollinger, Supanakorn and Boggs; (2010), Brookes, (2010), Chester, Buntine, Hammond and Atkin, (2011). Bollinger (2010) reported that females had a higher level of retention and felt that the content presented in the podcasts were more relevant for females than males. Gajasinghe (2007) found that male students listened to podcasts more than females most especially in Biology. Based on the above

literature, this study examined the efficacy of podcast on achievement and retention of N.C.E (II) Biology students in Niger state, Nigeria.

### Statement of the Problem

The challenge for higher education continued to grow as students born in the digital and mobile age are approaching learning from a very different perspective than their predecessors. One major problem that has been identified with the traditional lecture format is that students' levels of engagement tend to be low, which may cause their learning to suffer and at the end affect their academic achievement (Sun, Martinez & Seli, 2014). It is of high benefit to blend traditional lecture with online technologies so as to enhance the teaching and learning process and improve students' academic performance in higher education. (Shing, Tir & Hanefar, 2011).

In Nigerian higher institutions today, much has not been done in the area of podcasting especially in employing it as a supplementary tool with lectures. To the best knowledge of the researcher, there are few studies that has been carried out in that area, specifically on the effect of podcasts on the achievement of students. Appendix A shows the number of percentage high grades and low grades in Biology at NCE II in Nigeria. The analysis shows that the performance continues to fall below 50% for the period of five years reviewed, although grades "D" and "E" are considered to be Passes but these are not good enough for pre-service teachers at college of Education that wish to further their education into the Universities. This study aimed at finding a lasting solution to the declining N.C.E (II) Biology students' achievement and retention using lecture recorded podcast for students to download for playback on their mobile devices and/or personal computers. The use of podcasts may help to solve problem of population explosion in our lecture rooms, unavoidable absence of students and teachers from

lectures, also difficult concepts can be listen to continuously until grasp by students. If this is not done in the system of education students will continue using their phone for social activities at any point in time. In view of this, the study is therefore aimed at examining the efficacy of podcasting on N.C.E (II) Biology students' achievement and retention in individualized and collaborative settings.

### Research Questions

The following research questions will be raised to guide in carrying out the study:

- I. What are the effects of podcast on achievement of N.C.E (II) students taught Biology in Think- Pair Share, Reciprocal Peer Teaching in Collaborative settings and Individualized setting?
- II. What is the difference in the achievement scores of male and female N.C.E (II) students taught Biology using podcast in Think- Pair Share setting?
- III. What is the achievement of NCE (II) when taught Biology using podcast in Reciprocal Peer Teaching?
- IV. What is the difference in the achievement scores of male and female students taught Biology using Individualized Setting?

### Research Hypotheses

The following null hypotheses would be tested in this study at alpha level of 0.05 based on research questions generated above:

- HO<sub>1</sub>: There is no significant difference in the mean achievement scores of N.C.E (II) students taught plant physiology in Think-Pair Share, Reciprocal Teaching and Individualized settings.
- HO<sub>2</sub>: There is no significant difference in the mean achievement scores of male and

- female Biology students taught plant physiology using Think- Pair Share.
- H<sub>03</sub>: There is no significant difference in the mean achievement scores of male and female Biology students taught plant physiology using Reciprocal Peer Teaching.
- H<sub>02</sub>: There is no significant difference in the mean achievement scores of male and female Biology students taught plant physiology using Individualized Setting.

test, non-equivalent, non-randomized control group (Fraenkel & Wallen, 2008). This design involves three levels of independent variables which are think -pair- share, reciprocal peer teaching type of collaborative learning and individualized learning of podcasting. One level of dependent variable of achievement; and two level of gender (male and female). The experimental and control groups were given the pretest and posttest. Experimental group I was subjected to treatment using podcast to augment think-pair- share in collaborative setting; experimental group II were subjected to treatment using podcast in reciprocal peer teaching in collaborative setting. While the control group was taught similar Biology, concepts using podcasts in individualized setting. The design layout is as shown below in table I:

## METHODOLOGY

### *Research Design:*

The design that was adopted for this research was quasi- experimental design. It involves a pre-test, post-

**Table I:** Research Design Layout

Groups	Pretest	Treatment	Posttest
(Experimental Group I)	O <sub>1</sub>	P + TPS	O <sub>4</sub>
(Experimental Group II)	O <sub>2</sub>	P + RT	O <sub>5</sub>
Control Group	O <sub>3</sub>	P + IL	O <sub>6</sub>

### **Keys:**

- O<sub>1</sub> represents the Pre-test scores of Experimental groups I (Think- Pair- Share)
- O<sub>2</sub> represents the Pre-test scores of Experimental group II (Reciprocal peer Teaching)
- O<sub>3</sub> represents the pre-test scores of controls group (Individualized Learning)
- O<sub>4</sub> represents the post-test scores of Experimental groups I (Think- Pair -Share)
- O<sub>5</sub> represents the post-test scores of Experimental group II (Reciprocal peer Teaching)
- O<sub>6</sub> represents the post-test scores of Controls group (Individualized Learning)

### *Population of the Study*

The population for this study was made up of all NCE II students offering Biology combinations at all Colleges of Education in Niger State of Nigeria. The target population is One Thousand Eight Hundred and Seventeen students (1,817) for 2015/2016 academic session.

### *Sample and Sampling Techniques*

The sample for this study was made up of all NCE II students offering Biology combination in three Colleges of Education in Niger State. The sample size was Two Hundred and Five (205) NCE 200level Biology combination students. The researcher adopted two stage sampling techniques. Three Colleges of Education in Niger State were used for the research. Intact class was used. By implication, students offering Biology combination group participated in

this study. Each of the selected school was allocated into experimental group (Think-Pair-Share, Reciprocal Peer Teaching) and control group (individualized setting) using simple random sampling technique (hat draw). The students in Think-Pair-Share formed a two (2) member group to listen to the podcast together and share ideas while the Reciprocal Peer Teaching formed a six (6) member group, taking each episode of the podcast to listen to they take turn teaching and explaining to each other what they have listened to. The lecturer serves as a guide to the group. Finally, stratified sampling technique was used to deal with gender, by implication putting different strata into different stratum that is (male and female).

## RESEARCH INSTRUMENTS

The instruments that were used for this study are: (i) treatment instrument and (ii) test instrument. The treatment instrument is Podcast package on teaching and learning of Biology (plant physiology) while test instrument that was used for data collection is Plant Physiology Concept Achievement Test (PPCAT). PPCAT was drawn from concepts that were taught and was administered as pretest in the first week of the experiment and posttest after six weeks of treatment.

### *Treatment Instrument*

The researcher prepared the paper scripts and lesson plan which were done in episodes; these were in two phases that is: introductory part, and the main content of the scripts. The introductory part consists of the content of the course, aim and objectives, and the presenter handled the course plant physiology (BIO 221). The second part consists of seven episodes in which the presenter divided and developed the content of plant physiology (BIO 221). Episodes of Podcasts on plant physiology Concept were

designed and developed by the researcher using ADDIE model guided by IMPALA model of Podcasting. The researcher recorded audio files that were edited using Pinnacle studio 14. The audio files were compressed using any audio converter to reduce the file size for easy access and download by the samples. A blog was created and designed by the researcher. The podcasts were uploaded to the blog for the students to download them. The Think-Pair-Share (group I) listened to the podcast on plant physiology together, think about what they have listened to for about 5 minutes before coming together to discuss the content of what they have listened to among themselves in the class; individualize group, students listened to content of podcast on plant physiology individually, while, reciprocal peer teaching group listened to content of podcast on plant physiology together taking turns to teach it among themselves while the teacher monitors and evaluates to determine where scaffolding is needed. A questionnaire was prepared on prepared Podcast on Plant Physiology concept which consist of 16 - item questionnaire to test functionality, audibility and clearness of the instrument. The responses of respondents in the field trial validation were positive.

### *Test Instrument*

The Podcasts on Plant Physiology Concept Achievement Test (PPCAT) is researcher-designed tests that were used for the Pre-test and post-test for the groups. This test covered the instructional content on selected plant physiology concepts. The test comprises of 34 questions which is a multiple choice objective questions with four options ranging from (A-D) and out of which there is one correct answer and three distracters which require the students to provide a short answer as shown in the table 2. The students were given thirty minutes (30 minutes) to answer the questions.

**Table 2:** Table of Specification on Plant Physiology

Content	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
Plant Physiology	8	6	8	3	5	8	<b>34</b>

From the table 2 eight questions were derived from aspect of knowledge, Six question on comprehension, eight questions on application, three questions on aspect of analysis, five questions from synthesis and eight questions from evaluation using Blooms' Taxonomy.

### ***Validation of Research Instruments***

**(i) Treatment Instrument:** The validation of podcast was done in three stages: (i) expert validation (ii) content validation (iii) field trial validation (group and individualized learners).

**Expert Validation:** The developed podcast package was given to two educational technologists from Department of Science Education, Federal University of Technology, Minna to validate the package in terms of its suitability for instruction, simplicity, unity among other illustrations key concept's, the presentation of the package, in terms of audibility, language used and voice of presentation among others was used to correct some mistakes while their suggestions were used to improve the package. The package was burn on CD instead of flash-drive to avoid distribution of viruses.

**Content Validation:** The Biology contents of the package was validated by four experts, one from Science Education Department, two experts from Biological Sciences Department, Federal University Technology, Minna and one from Biology department, Niger State College of Education, Minna before the package was developed. They were requested to carry out face and contents validation

of the instrument by ensuring that all items were derived from the content that would be presented to the three groups. The face validity in relation to background of students was also considered. The validators were check whether the contents of podcast adequately and sufficiently covered the Nigeria NCE curriculum. After the package was developed, it was validated to determine the appropriateness of the package for teaching the chosen topics; clarity and simplicity of the packages as well as suitability for the level of students; the extent to which the content covers the topics they meant to cover; possible errors in suggested answers; and the structuring of the package. After the validation, some sentence errors, spelling mistakes in the package discovered were also corrected. The test items and contents of the package were later corrected or modified on the basis of suggestion and recommendations of the experts.

**(ii) Validation of Test Instrument:** PPCAT was given to four Biology experts, three from Federal University of Technology and one from Niger State College of Education, Minna. These experts assessed the face and content validity of instrument in relation to the background of NCE curriculum. In addition, the experts were requested to critically examine all the items in the test instrument with reference to the appropriateness of the content, the extent to which the content cover the topics they were meant to cover, and many others. Finally, comments, opinions and suggestions of the experts were used to make necessary amendments on the

instrument.

**(iii) Field Trial Validation:** The podcast package was trial-tested on 10 Biology combination students from Kwara State College of Education, Ilorin. The students from Biology combination were grouped into three to listen to podcast and discuss it immediately (Think – Pair Share) group, Reciprocal Peer Teaching group also listen to podcast and discuss it after they have read about the content of package while the third group (Individualized Learning) listen to the package on an Individual basis without discussing with their colleagues.

The trial test took place immediately after the second semester examinations, a week before holiday. Both Think–Pair–Share and Reciprocal groups comprised three-members while Individualized setting is a four-member student. The seven episodes were listened to by each group after the whole processes 16-item questionnaire was administered to the students and retrieved immediately after they had responded to it. The responses of respondents in the field trial validation were positive.

### ***Reliability of Research Instrument***

Pilot test was conducted on Ten NCE II Biology Education students from Kwara State College of Education Ilorin. PPCAT was administered on the selected students and data collected were subjected to analysis using Kuder-Richardson 21, (KR-21). Reliability coefficient of 0.74 was obtained which shows that the instrument was reliable. Questionnaire was administered to the same set of students; data collected was subjected to Cronbach Alpha. Reliability coefficient of 0.81 was obtained which shows that questionnaire was reliable.

### ***Method of Data Collection***

The researchers sought for the schools' approval before embarking on the study. The lecturers and students that involved in the study were trained using Podcast Operational Guide. This training and demonstration sessions on the procedure for carrying out the experiment lasted for one week. The training was done according to procedures for implementing collaborative learning using for podcast.

### ***Experimental Procedures***

**Think-Pair-Sahre:** The experimental group Think-Pair – Share were in pair forming thirty-five (35) groups. Each group were to listen to the seven episodes although the first episode is introduction so six episodes is what they listened to, dividing the topics among the group members, each group listen and discuss among themselves sharing ideas on what they have heard.

**Reciprocal Peer Tutoring:** Experimental group II Reciprocal Peer Teaching are six in a group; each member is assigned to one episode each to study and take turn among the group to teach other what they have learnt while listening to the podcast.

**Individualized Learning:** Individualized group is the control group. They listen to each episode individually without discussing with their colleagues. After this posttest were administered to the students.

After administering specific treatment to each group for six weeks, PPCAT was administered to all the groups after the treatment. The pre-test and post-test were scored according to the marking scheme and the results were subjected to data analysis.

### ***Method of Data Analysis***

Data collected were analyzed using descriptive statistic of mean and standard deviation to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the null hypotheses. Sidak Post-hoc test was used to determine where the difference exist among the groups. The various

hypotheses were tested at 0.05 alpha ( $\alpha$ ) level of significance.

## RESULTS

### Research Question One

(i) What are the effects of podcast on

achievement of N.C.E (II) students taught Biology in Think- Pair Share, Reciprocal Peer Teaching in Collaborative settings and Individualized setting?

To answer the research question 1, mean and standard deviation was calculated as shown in Table 3.

**Table 3:** Mean gain scores of students Taught Plant Physiology Concept Using Collaborative and Individualized Settings

Groups	Pretest		Posttest		Mean Gain Score
	Mean	SD	Mean	SD	
Think- Pair Share	41.69	13.38	46.87	12.12	4.38
Reciprocal Peer Teaching	37.62	12.58	47.75	12.53	10.13
Individualized setting	40.94	12.74	46.30	12.61	5.36

From Table 3, reciprocal peer teaching had highest mean gain score  $10.3 \pm 0.05$  followed by individualized setting with the mean gain score of  $5.36 \pm 0.13$ ; while think- pair -share had the least mean gain score of  $4.38 \pm 1.26$ . This indicates that all the groups benefited from the treatment, with reciprocal peer teaching having the highest plant physiology concept achievement test.

**Research Question 2:** What is the achievement of NCE (II) when taught Biology using podcast in Reciprocal Peer Teaching?

To answer the research question 2, mean and standard deviation was calculated as shown in Table 4.

**Table 4:** Mean gain scores of male and female students taught Plant Physiology Concepts using Think- Pair- Share

Groups	Pretest		Posttest		Mean Gain Score
	Mean	SD	Mean	SD	
Male	39.40	10.74	47.72	11.43	8.32
Female	42.96	14.61	45.16	12.51	2.20

From the Table 4, Male students have a higher mean gain score of  $8.32 \pm 0.69$  while female students have a mean gain score of  $2.20 \pm 2.10$ . This indicates that all the groups benefited from the treatment, with male students having better posttest achievement than female students.

**Research Question 3:** What is the achievement of NCE (II) when taught Biology using podcast in Reciprocal Peer Teaching?

To answer the research question 3, mean and standard deviation was calculated as shown in Table 5.

**Table 5:** Mean Scores of NCE II Students Taught Biology Using Podcast in Reciprocal Peer Teaching Group

Groups	Pretest		Posttest		Mean gain Score
	Mean	SD	Mean	SD	
Male	42.89	12.09	52.59	12.53	9.70
Female	33.87	11.67	44.32	11.50	10.45

From Table 5, It shows that female students have higher mean gain score of 10.45  $\pm$  -0.17 while the male students have a mean gain score of 9.70  $\pm$ 0.44. This indicates that both male and female students benefited from the treatment.

**Research Question 4:** What is the difference in the achievement scores of male and female students taught Biology using Individualized Setting?

To answer the research question 3, mean and standard deviation was calculated as shown in Table 6.

**Table 6:** Mean Scores of Male and Female Students Taught Biology Using Individualized Setting

Groups	Pretest		Post-posttest		Mean Gain Score
	Mean	SD	Mean	SD	
Male	40.61	4.76	49.66	11.93	9.06
Female	41.50	8.54	40.60	11.86	-0.9

From Table 6 The male has achievement scores of 9.06  $\pm$  7.17 and the female has the achievement scores of -0.9  $\pm$ 3.32. The male student has the higher mean gain of 9.06.

physiology using podcast in think-pair-share, reciprocal teaching and individualized setting

Table 7 presents the result of the ANCOVA test using the pretest scores of students in the three groups as covariates.

### Hypothesis One

There is no significant difference in the mean achievement scores of NCE II students taught plant

**Table 7:** ANCOVA Results of student's taught Biology Using Think Pare- Share, Reciprocal Peer Teaching and Individualized Settings

Source	Sum of Squares	df	Mean Square	F-value	p-value
Corrected Model	247.251	3	82.417	0.53	0.66
Intercept	37095.167	1	37095.167	240.37	0.00
Pretest	136.265	1	136.265	0.88	0.01
Treatment	144.346	2	72.173	0.47	0.03*
Error	31021.139	201	154.334		
Total	478024.000	205			
Corrected Total	31268.390	204			

\*: Significant at 0.05 alpha level

The result of the analysis in Table 7 indicates that an  $F(2, 205) = 0.47$ ,  $p = 0.03$  for the main effect was significant at 0.05 alpha level. This implies that there is a significant difference in the achievement score of NCE II students taught plant physiology using think- pair -share, reciprocal peer teaching and

individualized setting. As a result of the establishment of a significant difference, a post-hoc analysis using Sidak test was conducted to determine the direction of difference among the three achievement scores. The results of the analysis are as shown in Table 8.

**Table 8:** Sidak Analysis of Students taught Plant Physiology using Think-Pair- Share, Reciprocal Teaching and Individualized Setting

Groups	Think Pair Share	Reciprocal Teaching	Individualized Setting
Think Pair Share	-	-1.68*	-0.23*
Reciprocal Teaching	1.68*	-	1.45*
Individualized Setting	0.23*	-1.45*	-

\*Significant at alpha level of 0.05

From 8 the Sidak post hoc analysis, group 1 is not significant with group 1, group 1 is significant compare to group two (reciprocal teaching) with negative value of -1.68 in favour of reciprocal teaching in addition, group 1 is significant compare to group 3 with negative value of -0.23 in favour of individualized setting . From the table above, it can be deduced that group 2 is significant compare t o group 1 with positive value of 1.68 in favour of group2 (reciprocal teaching), group 2 is not significant compare to group 2, group 2 is significant compare to group 3 with positive value of 1.45 in favour

of group 2 (reciprocal teaching) in addition, group 3 is significant compare to group1 with positive value of 0.23 in favour of group 3 (individualized setting), group 3 is significant compare to group 2 with negative value of -1.45 in favour of group 2, otherwise group 3 is not significant compare to group 3

**Hypotheses Two:** There is no significant difference in the mean achievement scores of male and female Biology students taught plant physiology using think - pair- share

**Table 10:** ANCOVA results of mean scores of male and female students taught Plant Physiology Using Think-pair- Share group

Source	Sum of Squares	df	Mean Square	F-value	p-value
Corrected Model	230.938	2	115.469	.781	0.46
Intercept	16525.211	1	16525.211	111.818	0.00
Pretest	125.246	1	125.246	.847	0.03
Gender	76.753	1	76.753	.519	0.47 <sup>ns</sup>
Error	9901.705	67	147.787		
Total	158713.000	70			
Corrected Total	10132.643	69			

ns: Not Significant at 0.05 Alpha level

The analysis in Table 10 indicated that an  $F(1, 70) = 0.519$ ,  $p = 0.47$ , which is higher than 0.05 (i.e.  $p$ -value  $\alpha$ -value), suggesting that the main effect was not significant at 0.05 alpha level. This indicates that there was no significant difference in the achievement of male and female students taught plant physiology in think- pair- share group. Therefore, this hypothesis not rejected. This reveals that the male and female

achievements are similar when exposed to plant physiology in think pair share group using podcast.

**Hypothesis Four:** There is no significant difference in the mean achievement scores between male and female Biology students taught plant physiology using reciprocal teaching

**Table 11:** ANCOVA of male and female achievement of students taught Biology in reciprocal teaching

Source	Sum of Squares	df	Mean Square	F-value	p-value
Corrected Model	1545.315	2	772.657	5.630	.006
Intercept	8622.523	1	8622.523	62.829	.000
Pretest	463.982	1	463.982	3.381	.040
Gender	531.562	1	531.562	3.873	.054 <sup>ns</sup>
Error	8508.747	62	137.238		
Total	158282.000	65			
Corrected Total	10054.062	64			

ns: Not significant at 0.05 alpha level

The result of ANCOVA test as shown in Table 11 indicates that there was no significant difference in the achievement of male and female students taught Biology using reciprocal teaching. The main effect of treatment Group 2 (reciprocal teaching) on gender produced an  $F(1, 65) = 3.87$ ,  $p = 0.054$ . This result suggests that there was no significance at the 0.05 alpha levels. This hypothesis is therefore not rejected. This indicates that

male student's achievement was not significantly different from their female counterparts when both were taught using reciprocal teaching.

**Hypotheses Four:** There is no significant difference between mean achievement scores of male and female Biology students taught plant physiology using individualized setting

**Table 12:** ANCOVA Results of male and female achievement taught plant physiology in individualized setting

Source	Sum of Squares	df	Mean Square	F-value	p-value
Corrected Model	1354.768 <sup>a</sup>	2	677.384	4.720	.012
Intercept	11398.694	1	11398.694	79.422	.000
Pretest	18.108	1	18.108	.126	.724
Gender	1345.676	1	1345.676	9.376	.003*
Error	9615.932	67	143.521		
Total	161029.000	70			
Corrected Total	10970.700	69			

\*: Significant at 0.05 alpha level

The analysis in Table 12 shows that the main effect of the treatment Group3 (individualized setting) on gender alone produced an  $F(1, 70) = 9.376$   $p = 0.003$ . This result was significant at the 0.05 alpha - level. This hypothesis is therefore rejected.

## DISCUSSION

The study revealed that students in reciprocal peer teaching group performed highest among the strategies considered in this research. This finding agrees with findings of Omotayo-omomule and Onansanya (2016) who conducted a research on effect of podcast on undergraduates performance in selected educational technology concepts their findings revealed that podcast enhance achievement of students also agree with earlier findings of Mike et., al (2011), who conducted a research on podcasting in physical education in teacher education and their finding revealed that majority rated podcasts high in terms of being educationally helpful, Won ling et., al. (2011) who investigated on the effects of podcasting on achievement of students and their findings revealed that overall achievement of students with podcast was significantly higher than the students without podcasts also support the findings of Jeff et., al (2011) who investigated on mixed method study of impact of weekly podcast, written and recorded summarizes college course content on student achievement and attitudes, however, find out that podcast summaries were more effective teaching tool which produced improved students achievement and caused the student to view their evaluation, preparation and comprehension of course content optimistically. Nevertheless, disagree with finding of Ali and Hassan (2015) who conducted research on effects of applying podcast multimedia teaching system on motivational, achievement and learning among the students, find out that there was no significant difference in the performance of both experimental and control groups. This is as a result of researcher being able to monitor the students very well

during the course of study and podcast in form of reciprocal peer teaching involves listening to podcast and explaining to each other after listening the whole concept and it is clearly stated in some findings that peer tutoring enhances students' achievement.

The study also revealed that gender has no significant difference on achievement of NCE II Biology students taught using think pair share reciprocal teaching and individual setting. This finding concurs with the earlier works of Evan (2007) who conducted a research on effectiveness of m-learning in the of podcasting revision lecture in higher learning education revealed that boys perform better than girls, However disagree with earlier findings of Torrens (2009) who say there was no significant difference between achievement of male and female student taught in podcasting, this may be as a result of both male and female explaining to each other after they might have listened to podcast in think pair share and reciprocal peer teaching which show that both male and female participated equally in the group assignment which led to their achievement to be at the same level. Moreover, those girls in individualized setting could not have the same achievement with boys since women naturally listen to music and enjoy it more than using their time for meaningful things.

## CONCLUSION

It has been asserted that the students' achievement in plant physiology concept is poor in spite of the importance of the course towards producing sound and knowledgeable teachers from colleges of education. Conclusion arising from the findings of this study indicates that high population and instructional strategies that lecturers employ in teaching have significant effects on NCE II Biology students' achievement. If students are exposed to podcast in think-pair-share, reciprocal and individualized setting in which they constructively interact freely to learn

through listening to podcast and consciously depend less on their lecturers, their achievement could be improved in plant physiology, Biology and science subject drastically. In addition, male and female students benefited from collaborative group however, male performed better in individualized setting than their female counterparts since girls prefer listening to music for long hours than using their time for real work, moreover if the group is well monitored the female students might have performed better.

## RECOMMENDATIONS

Based on the major findings of this study, the following recommendations are proffered:

- (i) Colleges of Education lecturers should be exposed to the use of podcast reciprocal teaching instructional strategy that promote and encourage social interaction, active learning, team work which enhances achievement of NCE II students. In achieving this, lecturers in colleges of education should shift from teacher-centered to learner-centered approach such as think- pair- share and reciprocal teaching. In addition, curriculum developers should embrace and include the use of collaborative learning strategies with podcast instructional media into NCE curriculum.
- (ii) In attempt to bridge the gap between male and female students' academic achievement in Biological Sciences, lecturers in colleges of education should be encouraged to use think-pair-share and reciprocal peer teaching that is gender friendly which promote good teamwork among the male and female students.

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